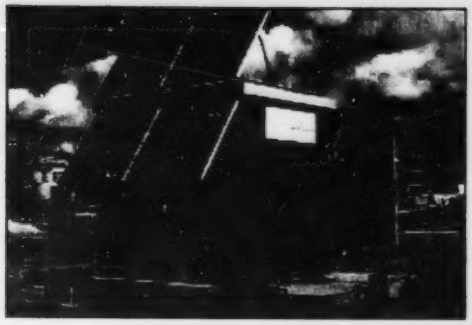
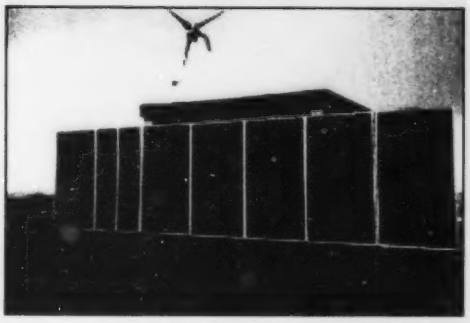
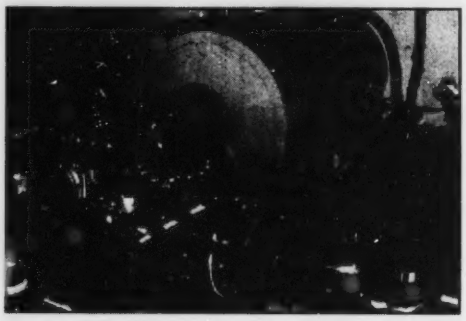
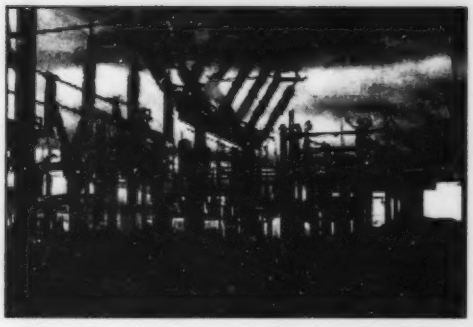


THE YUKON GREEN POWER INITIATIVE

IMPLEMENTATION STRATEGY







December 1999

Yukon Development Corporation

101-00335/

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THE YUKON GREEN POWER INITIATIVE

IMPLEMENTATION STRATEGY

December 1999

Yukon Development Corporation

MESSAGE FROM THE MINISTER

The Green Power Initiative Implementation Strategy is an important component of the Yukon government's comprehensive energy program that was developed in response to the Final Report of the Cabinet Commission on Energy. The strategy will achieve economic, environmental and social benefits for Yukon businesses and communities.

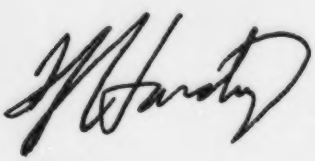
The Green Power Initiative was made possible through a $3 million contribution from the Yukon government to the Yukon Development Corporation in 1998. Its central goal is to increase the production and sale of small-scale renewable energy to meet the needs of communities and industry. The Green Power Initiative will also help to reduce greenhouse gas emissions.

To meet its central goal, the Green Power Initiative Implementation Strategy outlines specific options to:

- displace diesel production and reduce emissions;
- provide consumers with a green power option;
- expand the technical capability to develop green power alternatives; and
- improve the cost-effectiveness and long-term competitive base of green power alternatives.

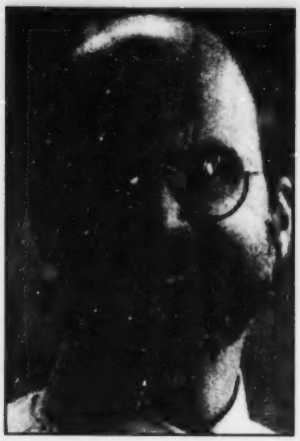
The strategy has been developed with the input of Yukon people, many of whom have promoted the development of green power technology for a long time. I encourage you to review this document and consider how it could be effectively applied to your own community.

I look forward to moving ahead with practical, innovative approaches to help resolve difficult energy issues through the Green Power Initiative Implementation Strategy.



Trevor Harding
Minister responsible for the Yukon Development Corporation

MESSAGE FROM THE CHAIR



The Yukon Development Corporation is pleased to be working with the Yukon government on the Green Power Initiative. The corporation's Board of Directors views this implementation strategy as a major step forward in the development of the Yukon's electrical infrastructure.

Programs based on the strategy will lead to partnerships among local power utilities, independent power producers, governments, communities and community organizations. The benefits will be a healthier environment and local employment through technology transfer, skills training and economic diversification.

Implementing more green power in the Yukon is going to be a challenge. But the potential benefits for communities, businesses and individuals make it worth the effort. Yukon Development Corporation looks forward to working with interested parties on this exciting initiative.

Ray Wells
Chair, Yukon Development Corporation

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INTRODUCTION TO THE GREEN POWER INITIATIVE

The Yukon Green Power Initiative forms part of the Government of the Yukon's response to the recommendations of the Cabinet Commission on Energy. It is a 10-year initiative, with an initial endowment of $3 million in a green power fund, managed by the Yukon Development Corporation. Its principal objectives are to:

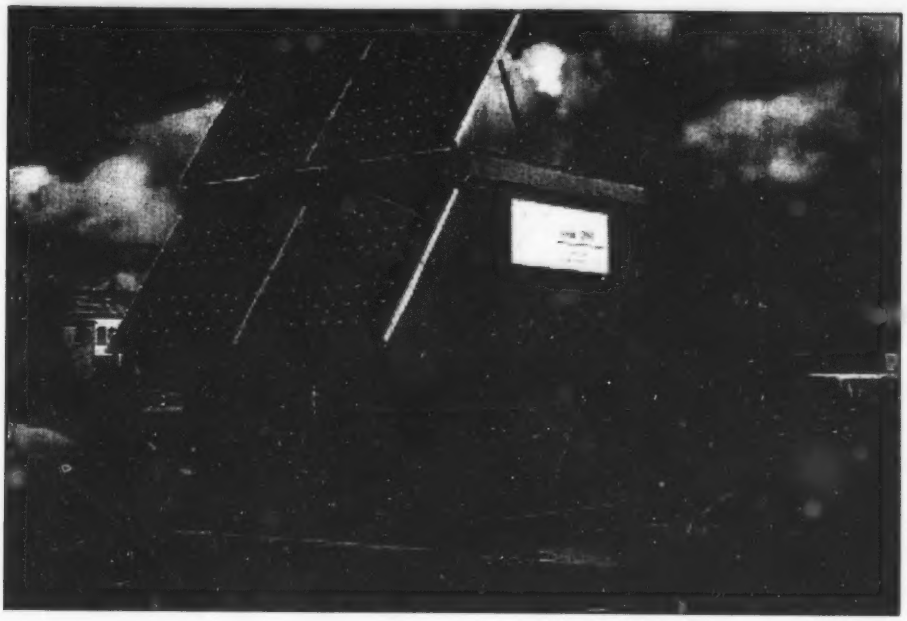
- displace diesel production and reduce emissions, particularly in communities served only by diesel-generated electrical power;
- provide consumers with a green power option and the challenge to take action to contribute to sustainable development;
- expand the technical capability to develop green power alternatives in the territory; and
- improve the cost-effectiveness and long-term competitiveness of green power alternatives.

In effect, the goal of the Green Power Initiative is to increase the production and sale of small-scale renewable energy to meet the electrical service requirements of Yukon communities and industry and reduce greenhouse gas emissions.

The Initiative is a companion program to other energy measures, such as the Energy Efficiency Initiative and the Wind Research and Development Initiative.

The goal of the Green Power Initiative is to increase the production and sale of small-scale renewable energy to meet the electrical service requirements of Yukon communities and industry and reduce greenhouse gas emissions.

GREEN POWER BENEFITS



Portable solar unit.

Yukon energy policy defines sustainability as "energy production, distribution and use that does not compromise the ability of future generations to produce and use energy, the health of the environment, and future availability of efficient, secure, reliable and affordable energy supplies."

The Yukon Green Power Initiative can benefit consumers, businesses and power producers.

Green power is part of this picture. There are environmental, economic and social benefits in green power.

Environmental benefits

- Reduced or no depletion of natural resources; and
- Improved resource management and environmental quality, such as reduced greenhouse gas emissions and noise, and improved local air quality and water use.

Economic benefits

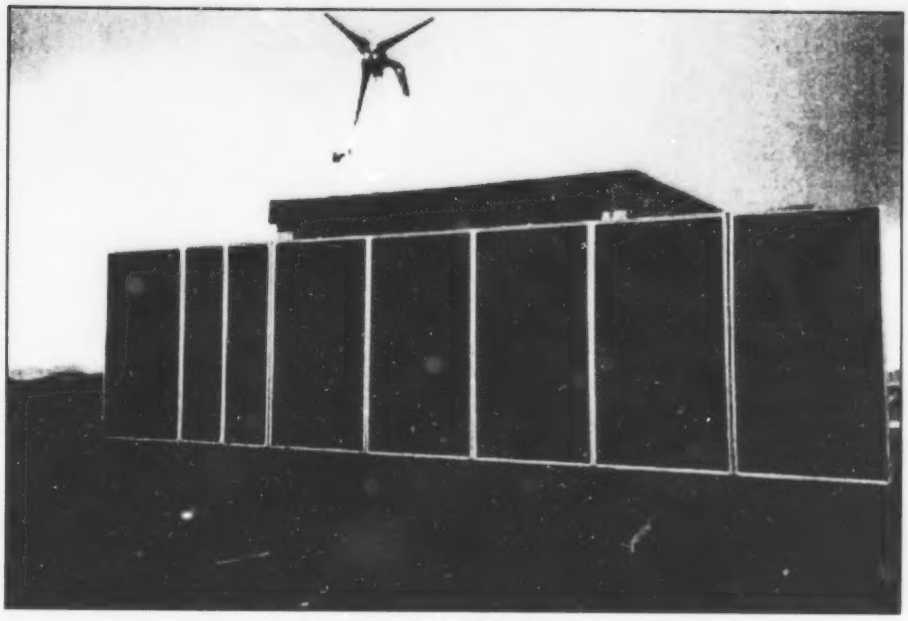
- Long-term cost reduction for the provision of electricity, particularly in remote communities;
- Regional economic development in the form of job creation and economic diversification;

- Reduced economic "leakage" (for example, an alternative to purchasing diesel from a non-Yukon supplier);
- New market opportunities, such as technology transfer from, and to, other regions;
- Sale of greenhouse gas emission credits; and
- Reduced risk in petroleum product supply and more stable electrical rates.

Social benefits

- Greater self-reliance of individuals and communities;
- Increased consumer choice of energy supply;
- Provision for consumer preferences toward environmentally benign products and services;
- Research and learning benefits and technological advancement; and
- Opportunities for collaboration among various parties, including First Nations, the private sector, government and non-governmental organizations.

WHAT IS YUKON GREEN POWER?



Wind monitoring station on Mount Sumanik, powered by a combination of wind and solar power.

Although definitions vary, "green power" is generally defined as electricity that is produced from renewable sources in an environmentally sustainable manner.

Green power is...electricity that is produced from renewable sources in an environmentally sustainable manner.

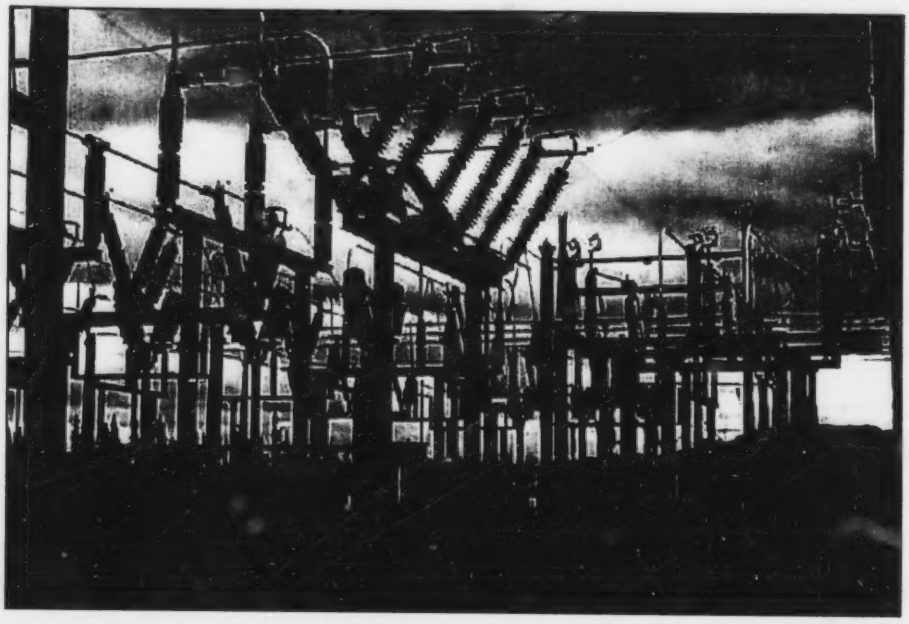
Most definitions of green power include the following core set of technologies.

- Hydro – environmentally benign hydro-electricity technologies, such as small scale hydro projects up to 20 MW and micro-hydro up to 1 MW;
- Wind – individual turbines and wind farms;
- Solar – solar photo-voltaic technologies that produce electricity and solar heating technologies that offset electrical loads (such as solar water pre-heat for electric boilers or space heating); and
- Biomass – solar energy stored in green plants and other organic material; biomass facilities burn wood, agricultural wastes and/or methane gases from landfills to spin a turbine that generates electricity.

For the purposes of the Green Power Initiative, we are using this core set, although we are limiting biomass applications to the use of wood to generate electricity and heat. (For example, this occurs when the waste heat off of a wood-fired steam turbine is used for heating purposes.)

In the future, this definition of green power may be amended to add other technologies such as fuel cells, once those technologies have been refined to a degree that would allow for effective application in the Yukon.

AN IMPLEMENTATION PLANNING FRAMEWORK



Takhini substation belonging to Yukon Energy Corporation.

The Green Power Initiative must operate within the larger context of energy supply in the Yukon. This includes:

- meeting existing and forecast demands for power;
- maximizing benefits from existing infrastructure and operational plans;
- incorporating green power in utility supply-side planning;
- following technical and safety standards;
- respecting rate structures and other regulatory arrangements; and
- working within a relatively small and isolated electricity supply and delivery system.

Although many options for how the initiative might run were identified through research, public consultation and implementation planning, not all are suitable for the Yukon. There are a number of complementary federal programs in place and there is no need to duplicate these.

In large part, the implementation strategy builds on local experience while taking advantage of new and relevant developments across North America.

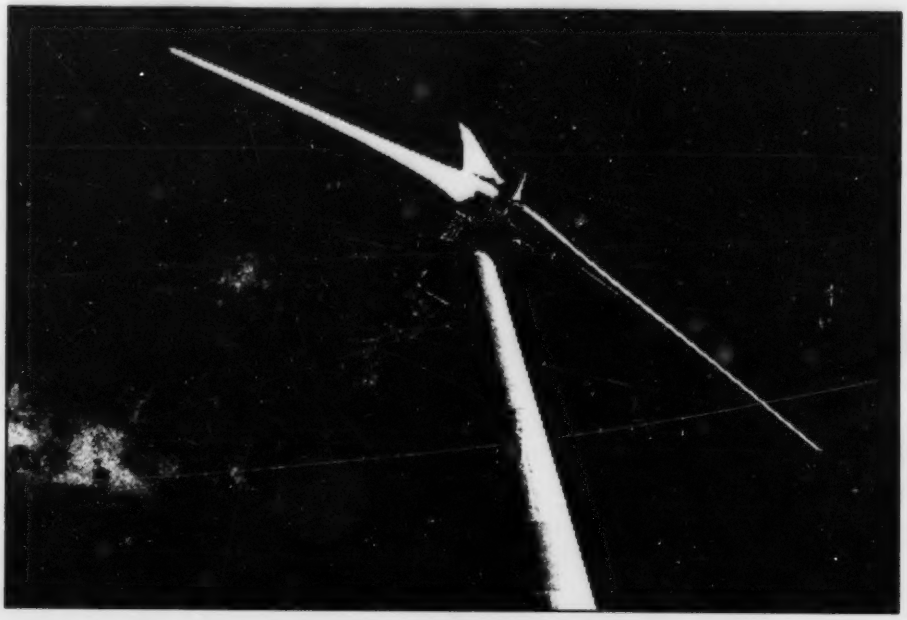
Integral to the implementation approach are provisions to enable independent power producers, individual consumers and other new partners to participate in the energy supply sector.

A public awareness component will provide Yukoners with information about green power technologies and their use in the territory.

Yukon Development Corporation will coordinate the implementation of the strategy with other related initiatives, such as the Wind Research and Development Initiative and the Energy Efficiency Initiative, to maximize benefits from green power investments.

In the end, the Green Power Initiative must provide the reliable power and choices that Yukon consumers expect.

CHALLENGES AND OPPORTUNITIES – A YUKON PERSPECTIVE



Wind turbine on Haeckel Hill in Whitehorse.

The Yukon situation is unique.

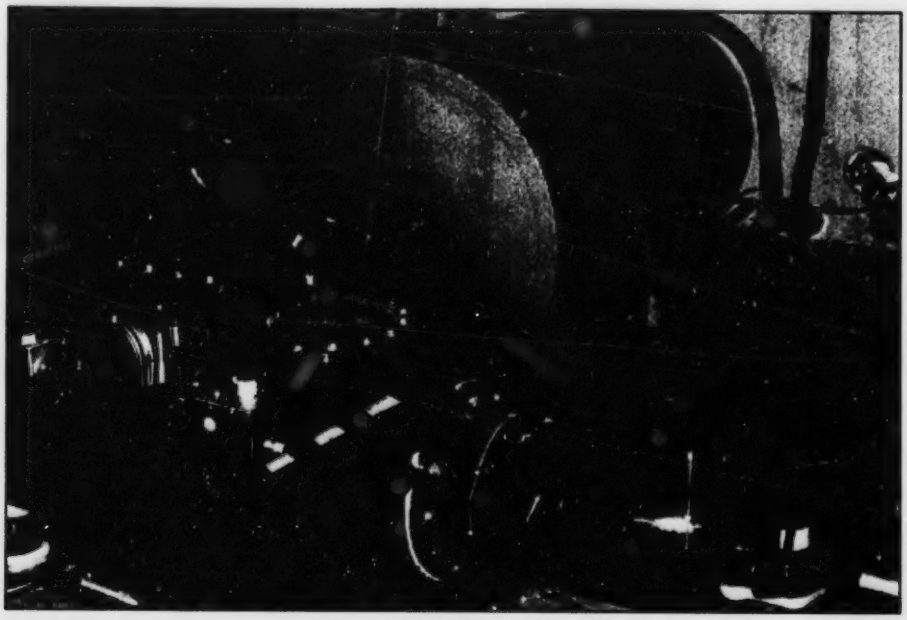
In some cases, local circumstances provide unique opportunities; in others, they present significant challenges to green power implementation.

- **Instability of demand** Demand for power in the Yukon can fluctuate widely from year to year, particularly on the Whitehorse-Aishihik-Faro (WAF) grid. For example, power requirements on the WAF grid can fluctuate by 40 percent just on the basis of whether the Faro mine is operating or not. Although these issues are addressed by energy supply planning, it remains risky for a utility or an independent power producer to add capacity to the power system that could become surplus while it still must be paid for.
- **Isolated grid** The isolation of the Yukon's power grid from other jurisdictions means it is not possible to manage a surplus situation through sales to the southern North America energy market.
- **Seasonal and peak requirements**: Most power is used in the winter months, particularly at specific times of the day (7 to 9 in the morning and 5 to 8 in the evening). Reliable and flexible power supplies must satisfy these requirements. Some of the diesel communities with high transient markets in the summer, such as Watson Lake and Dawson City, have a summer peak that matches their winter peak load.

In some cases local circumstances may provide unique opportunities; in others, they may present significant challenges.

- **Rural diesel communities** These communities provide opportunities for green power technologies to replace or augment diesel generation. Site-specific options may be limited by geography and the small size of the market.
- **Available resources** The Yukon has a solid renewable resource base, including sunlight, wind, rivers and streams, and wood waste.
- **Resource fluctuations** With fluctuating levels of precipitation and run-off, the supply of power from hydro sources can vary. However, it is most plentiful in summer when demand for power is lowest. Wind power is dependent on sufficient wind. These practical realities can pose a challenge or an opportunity for green power.
- **Cost-competitiveness** There is debate about how to compare the real costs of conventional and green power given existing infrastructure investments, the tax and financial structure of the electrical utilities, and regulated rates. A balanced cost-benefit analysis of energy investments would look at things from a sustainable development approach, as well as considering incremental and avoided costs of generating power. This would contribute to the comparative advantage of green power options.
- **Northern conditions** The seasonal, geographic and climatic conditions of the north have a bearing on energy options.
- **Greenhouse gas emissions** As part of international efforts to deal with climate change, national requirements for reducing emissions from fossil fuels are anticipated. This may be a significant factor in future energy supply decision-making.
- **Other considerations** As with other essential services, ratepayers want stable, affordable electrical rates and "least cost" reliable power. At the same time, consumer preference for green power must be met.

IMPLEMENTING THE YUKON GREEN POWER INITIATIVE



Micro-hydro turbine at Fraser provides power to the Yukon Highways maintenance station. (Photo courtesy of New ERA Corporation)

Yukon Development Corporation has taken a "tool box" approach to the Green Power Initiative. The "tools" that are included in the implementation strategy were discussed in a public consultation process and determined to be practical from a Yukon perspective.

Yukon Development Corporation has taken a "tool box" approach to the Green Power Initiative.

Here are the four components of the implementation strategy.

- Green power information and training;
- Green power research and development;
- Tendering and constructing green power projects; and
- Green power marketing and consumer choice.

Green power information and training

The principal objective of the information and training component is to increase awareness, interest, and understanding of green power among energy consumers and suppliers, and provide the motivation to take action. To address this objective, the information and training component has three elements.

- **Public awareness**: This will include public information materials, advertising, displays, workshops and educational sessions. It will

Most of the work done in this sector will involve resource assessments and refinements to existing technologies so that they can function in northern climates and remote communities.

support a "youth experiential learning" program in cooperation with the Yukon Department of Education. Public awareness will be an integral part of all green power program initiatives.

- **Information clearing-house** A clearing-house will be established to facilitate access to technical and program information. It will also offer a facilitation service to access programs.
- **Skills training and development** There will be support for training workshops and seminars for potential green power producers or associated service providers.

These three elements will build on existing programs, partnerships and resources at the local and national level. By not reinventing the wheel, they represent a relatively low cost approach to ensuring that potential green power participants and the public are both aware of and can effectively mobilize green power opportunities.

Green power research and development

The Yukon cannot independently support large scale research and development, although there are some possibilities to joint-venture with circumpolar neighbours, utilities, and federal agencies. With this practical limitation, the goals of this component are to:

- support resource assessments;
- refine existing technologies to function more effectively in northern climates and remote communities; and
- support pilot project test bed programs located in the Yukon.

To achieve these goals, this component will include the following elements:

- **Resource assessments – wind, solar, hydro and biomass**: This will build on and expand the existing wind power testing program by providing equipment and technical assistance and an active outreach program.

  It will also provide technical assistance in the form of information and advice regarding the generation potential of solar, hydro and biomass resources. Where data is inadequate to support decision-making, the initiative will consider providing additional monitoring and assessment support on a case by case basis. This will assist independent power producers and individuals assess resource potential on a site-specific basis.

- **Resource assessments – community opportunities** This will assist community-based authorities with practical renewable energy resource assessments.

- **Demonstration projects – new applications, technologies, and approaches:** There will be technical and financial assistance with the design and commissioning of green power demonstration projects for technologies that have not been fully tested in northern climates or applications. Technical assistance may include feasibility assessments and design contributions. Financial assistance may take the form of either flexible financing arrangements for some portion of the capital costs, or participation in partnerships with proponents. Proposals will be considered on a project by project basis.

These initiatives will build on the Yukon's experience with small-scale initiatives and existing mechanisms, while providing new incentives and assistance to potential participants.

The research and development component will build on the Yukon's experience with small-scale projects and existing programs, while providing new incentives and assistance to potential participants. At the same time, a goal will be to build partnerships and encourage investments from other sources.

In all cases, priority will be given to projects with the greatest potential to address the principal Green Power Initiative objectives.

Tendering and constructing green power projects

This is a key program component. The principal challenge to installing green power is the instability of demand for power in the Yukon. This is particularly the case when economic circumstances result in a significant hydro-power surplus on the system, such as when the Faro mine is down. Equally significant is the fact that many rural communities have small loads and are not connected to the power grid. In addition, green power remains marginally more costly than conventional power, although the gap is closing. The installation of green power, therefore, requires a new way of assessing options and making choices. Power supply options must be considered within the context of sustainability, financing, pricing, and the regulatory structure of the Yukon energy supply system. This component addresses three objectives of the initiative.

- Displace diesel production and reduce emissions, particularly in communities served only by diesel-generated electrical power.
- Improve the cost-effectiveness and long-term competitiveness of green power alternatives.
- Expand the technical capability to develop green power alternatives in the territory.

To address these objectives, the implementation strategy will use green power planning targets, long-term purchase agreements, production incentives, and an emission credit bank to support installing green power.

The strategy will ensure a viable green power option within the context of existing utility operations.

- **Green power planning targets** The Yukon's electrical utilities (Yukon Energy Corporation and The Yukon Electrical Company Limited) will be asked to cooperate on adopting green power planning targets for the purchase and/or supply of electrical power. These targets will consider present and future energy supply requirements, as well as existing infrastructure, and may include geographic, seasonal and capacity provisions. Priority will be placed on installing green power facilities to replace diesel in remote communities. Other factors, such as minimizing transmission line losses, improving power quality and extending the operating life of current diesel generating assets, will also be considered as part of the process.

- **Long-term power purchase agreements** Opportunities to participate as a power supplier will be offered by Yukon Energy Corporation through a competitive bidding process, or, in special circumstances, may involve direct negotiations with strategic partners. To provide a viable opportunity for participation by independent power producers, two key issues will be addressed:

  - setting a price that reflects the real cost of producing green power; and
  - contracting to purchase power over a term that is adequate to allow reasonable protection of the capital invested in infrastructure (10 years).

  To address these issues, Yukon Energy will be encouraged to enter into long-term power purchase agreements with independent power producers.

- **Green power production incentive** As an adjunct to these purchase agreements, Yukon Development Corporation may pay a production incentive for each unit of power purchased to cover incremental green power generation costs. Under current market conditions green power is generally more costly to produce than traditional forms of energy. The production incentive will cover green power production costs above the "incremental cost" of diesel generation. Incremental costs are the utilities' cost to produce a unit of power. This includes operations and maintenance costs, but not capital costs. The production incentive provides a mechanism to make green power viable in the Yukon without changing power rates or other market structures. This program component will apply to new green power projects commissioned after January 1, 2000.

- **Emission credit bank**: There will be a service whereby emission credits resulting from green power projects can be consolidated. The Green Power Initiative will assume ownership of greenhouse gas emission credits in eligible projects funded in whole or in part by the initiative. Financial proceeds from the sale of credits will be re-invested through the Green Power Initiative, or may be shared with green power producers where agreed to pursuant to green power purchase agreements.

The principal objective of this program component is to make green power choices accessible to consumers.

Green power marketing and consumer choice

This will provide electricity consumers with an opportunity to actively participate in and support the objectives of the Green Power Initiative. The marketing goals include:

- promoting the installation and use of green power;
- enhancing electrical services and product choice;
- challenging consumers to participate and support green power; and
- encouraging the use of green power in isolated locations.

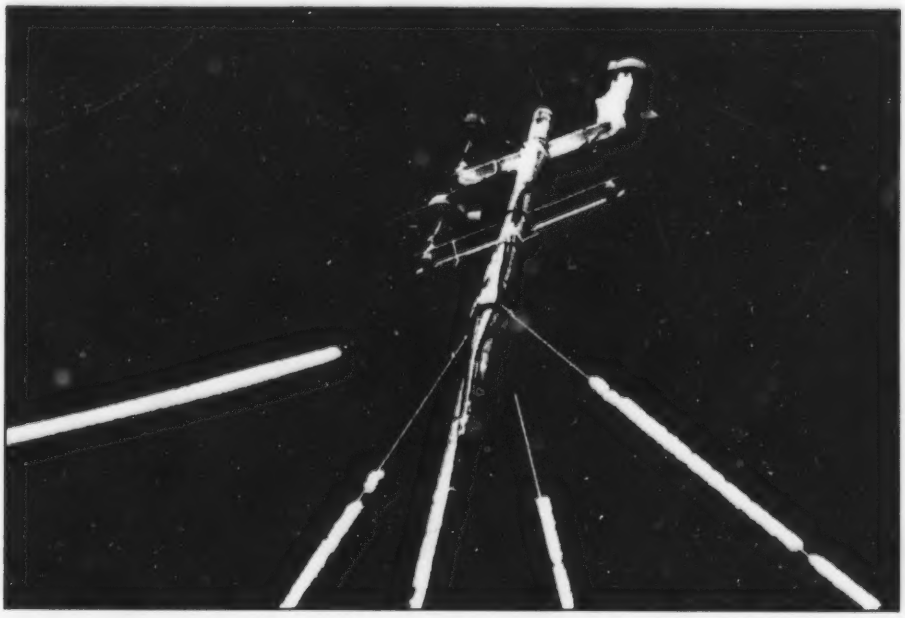
The green power marketing and consumer choice program will include three main elements.

- **Premium product sales** Yukon Energy Corporation and The Yukon Electrical Company Limited will be asked to include a green power contribution option as part of their regular customer services and billing. Consumer participation in this program will be voluntary, with net proceeds being re-invested to support the development and use of green power. This provides consumers with the choice of using green power and supporting its further development.
- **Net metering (or net billing)** This will allow customers to produce some of their own power and "bank" it on the utility system for later use. The amount generated by the customer-producer will be deducted from their monthly utility bills. Although the utility's monthly connection fee applies, the monthly energy portion of the bill can be reduced to zero. Consumers can use their own renewable energy systems while taking advantage of the utility service for reliability and additional power requirements. The initiative will assist the utilities in designing and implementing this service.
- **Rural Electrification Program** This low-cost financing program will continue to be used to promote the installation of alternative energy systems for rural property owners (outside municipalities). Options for extending the program to Yukoners not currently covered will be explored with program sponsors and delivery partners.

A public awareness component will provide Yukoners with information about green power technologies and their use in the territory.

In addition to these marketing initiatives, each program element will have a public awareness aspect designed to provide Yukoners with information about green power technologies and their use in the territory.

OPERATING PARAMETERS AND IMPLEMENTATION PRIORITIES



The top of a wind monitoring station on Haeckel Hill in Whitehorse.

Operating parameters

Managing for immediate and long-term results.

To implement the Green Power Initiative, the Yukon Development Corporation will:

- act in a manner that complements other elements of Yukon energy policy and programming, including initiatives such as energy efficiency;
- promote the integration of green power objectives into the electrical utilities' ongoing planning and decision-making process and management of the Yukon power supply system;
- develop and achieve measurable implementation targets for each component of the implementation strategy;
- respect regulatory principles;
- evaluate the feasibility of green power projects using a sustainable development approach;
- coordinate and collaborate with other agencies, producers, utilities, regulators, and stakeholders to maximize the impact of Green Power Initiative resources;
- administer the $3 million green power fund to sustain programming over the 10-year term of the initiative;

- review implementation every five years; and
- provide accountability for the Green Power Initiative through the existing mechanisms of the Yukon Development Corporation and its Board of Directors, including annual reporting to the Legislature and auditing by the Auditor General.

Implementation priorities

The Yukon Development Corporation has identified the following eight priorities as a focus for implementation in the first two years of the program.

- Proceed with request for proposals for generation and sale of green power, with a particular focus on displacing diesel in remote communities.
- Expand the wind monitoring program and initiate green power resource assessments in selected communities and sites.
- Implement suitable demonstration projects that build on Yukon experience.
- Proceed with the green power information and training component.
- Implement the voluntary green power contribution rate program (in conjunction with installation of the new Haeckel Hill wind generator).
- Promote green power through the Rural Electrification Program.
- Make arrangements to quantify, bank and market emission credits.
- Manage the green power fund to sustain green power programming over the 10-year term of the program.